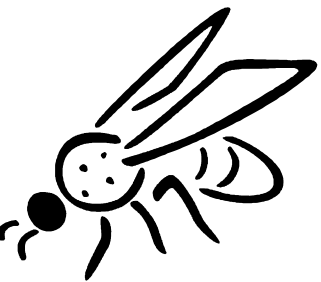


Northwest Hazardous Waste Conference

April 14, 2004

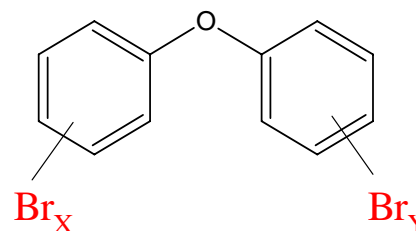




Ann Blake, Ph.D.



- Researcher
 - molecular genetics of neural development
- Regulator:
 - California Environmental Protection Agency, Department of Toxic Substances Control
 - » RCRA inspector, local agency oversight
 - » Northern California Pollution Prevention Coordinator
- Consultant
 - International POPs Elimination Network
 - Environmental Finance Center Region 9
 - Local governments, NGOs



Brominated Flame Retardants

- What are BFRs?
 - Broad class of chemicals, including PBDEs, TPPBA, HBCD
- Why do we use them?
 - Increased fire hazard with increased volume of flammable consumer products
- What's the concern?
 - Detected in human breast milk, ubiquitous in the environment
 - Found in blood of electronics recyclers
 - Routes of exposure remain largely unknown
- What's happening?
 - Voluntary Industry Phase-outs (electronics, Great Lakes Chemical)
 - Legislated Phase-outs (CA, WA, others)
 - Furniture Flammability regulations (CA TB117, CPSC national standard)

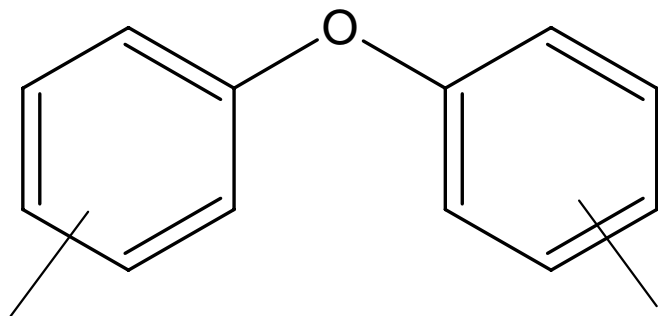


What Are the BFRs?

- Includes
 - Polybrominated diphenyl ethers, PBDEs
 - Bisphenols, Cyclododecane
- Commonly used as flame retardants
 - 95% of consumer electronics use deca-BDE
 - Computer casings, printed circuit boards, cabling, etc.
 - Upholstered furniture, drapes, carpeting
 - Penta-BDE in polyurethane foam
- 450 million pounds of BFRs manufactured annually worldwide
 - North America: highest usage; increasing in Asia, especially TBBPA



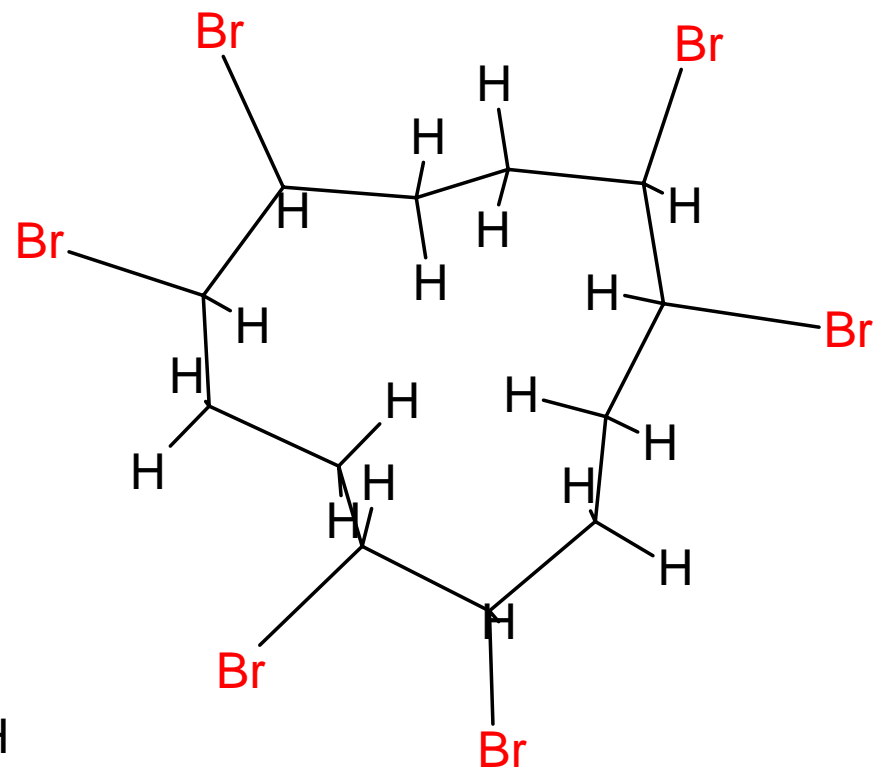
Chemical Structure of the BFRs



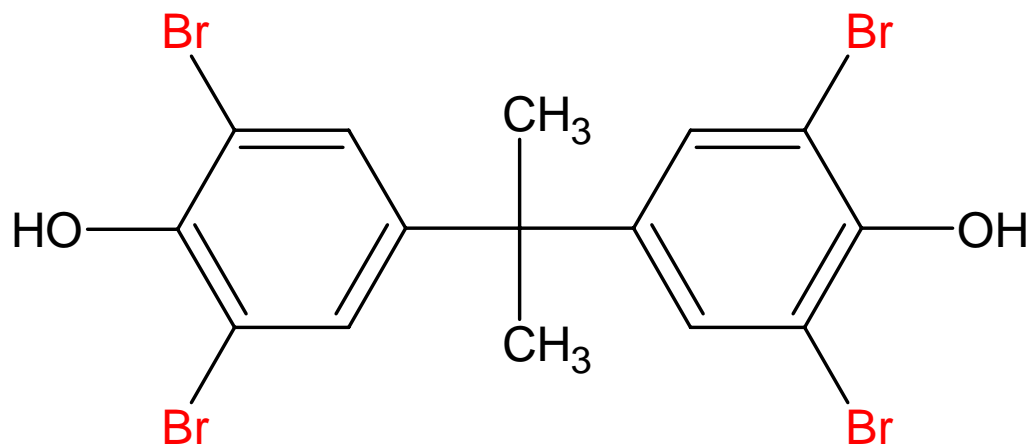
Br_X

Br_Y

Polybrominated diphenylethers (PBDE)



Hexabromocyclododecane (HBCD)



Tetrabromobisphenol A (TBBPA)

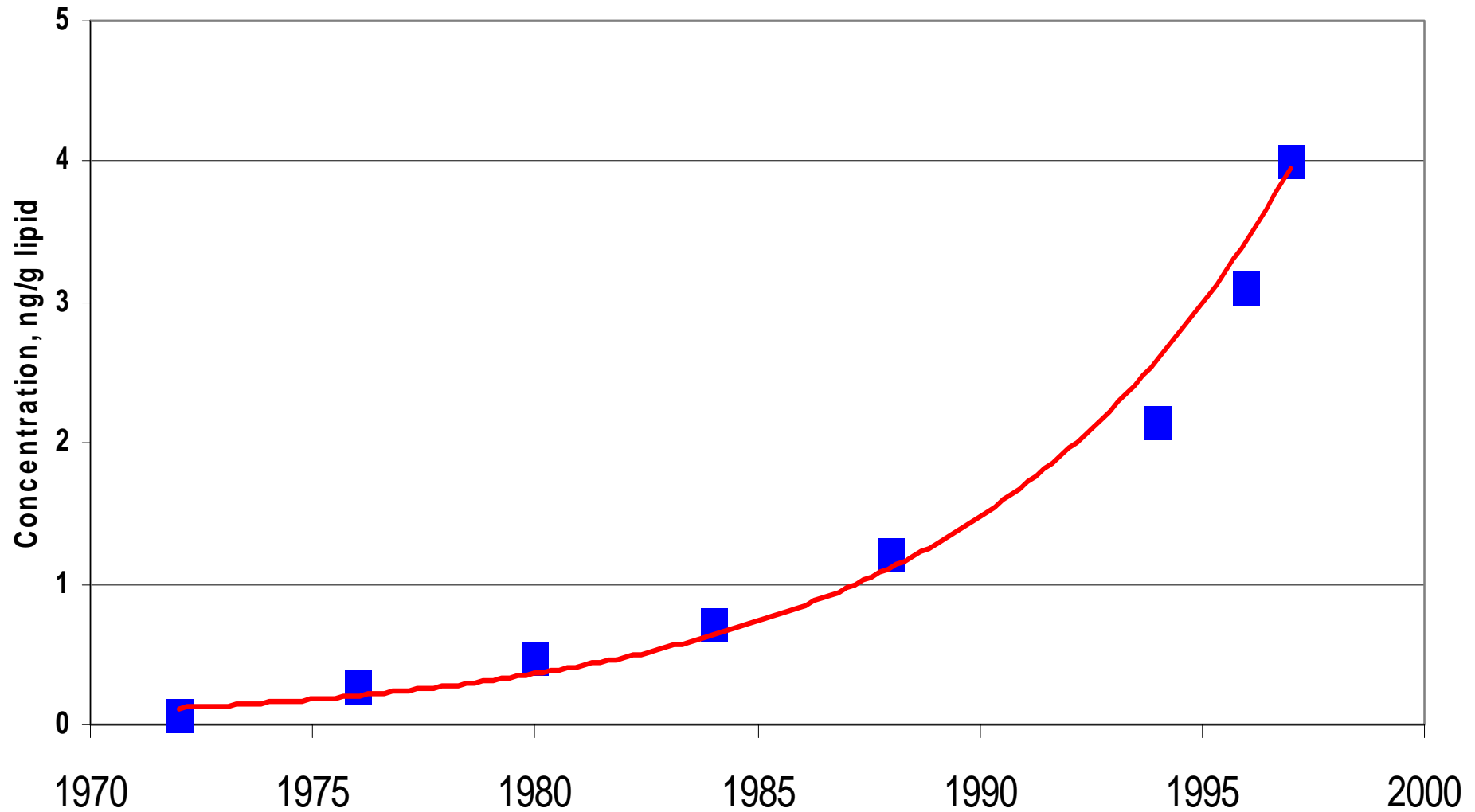
What's the Concern?

- PBDE concentrations are increasing in human tissue and biota
- PBDEs are of toxicological concern
 - Bioaccumulative
 - Endocrine disruptors
 - Affect fetal brain development
- Routes of exposure are largely unknown
 - Use or end-of-life exposure for consumer products?
 - Occupational exposure: recyclers, firefighters, others?
 - Air, soil, food?

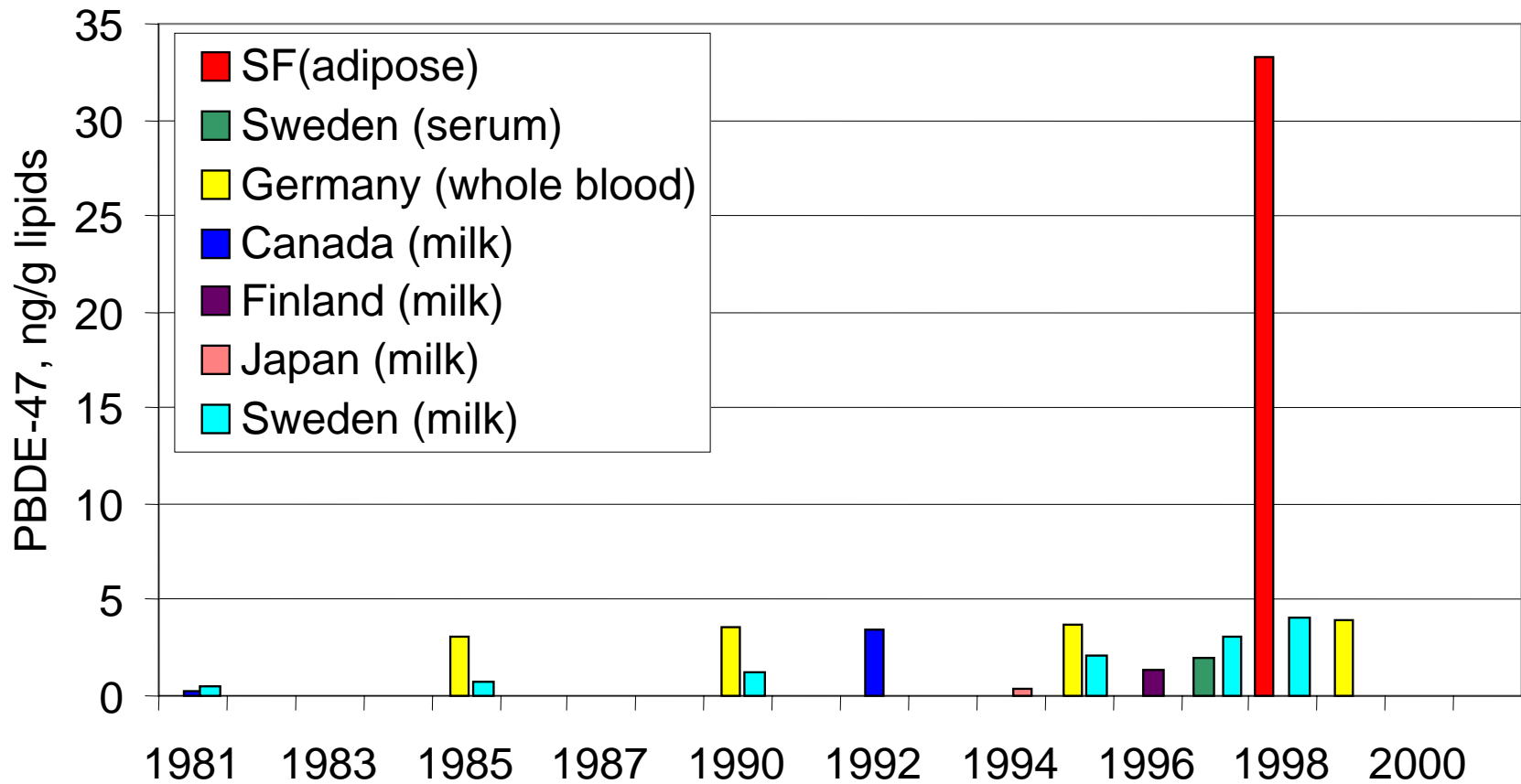


Total PBDEs, Swedish Milk Study

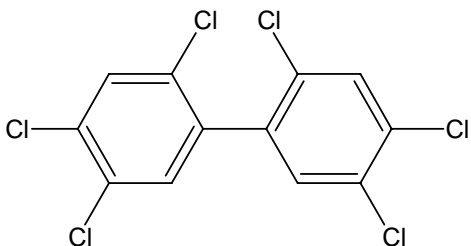
(Noren & Meironyte, 1998)



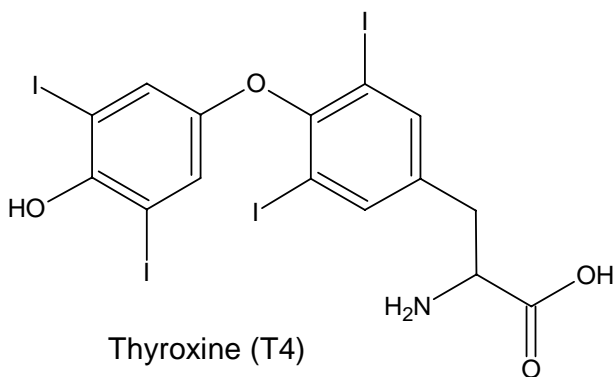
PBDE-47 in Human Tissues



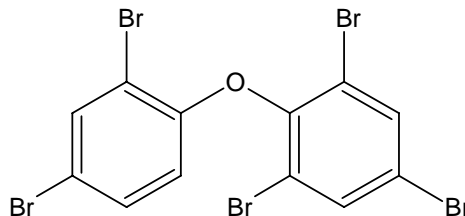
Structural Similarity of PBDEs, Their Metabolites and Environmental Derivatives to T4 and PCBs



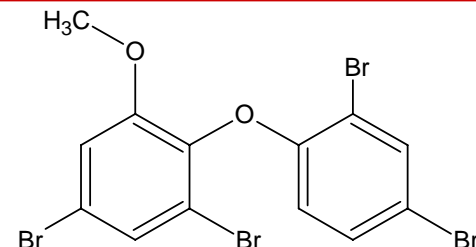
2,2',4,4',5,5'-hexachlorobiphenyl
(PCB-153)



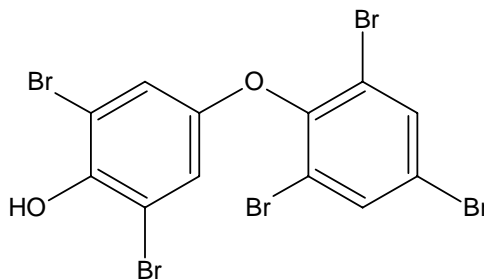
Thyroxine (T4)



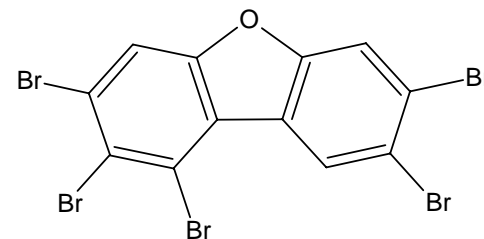
2,2',4,4',6-pentabromodiphenylether
(PBDE-100)



2-(2',4'-dibromophenoxy)-4,6-dibromoanisole
(methoxy-PBDE)



4-(2',4',6'-tribromophenoxy)-2,6-dibromophenol
(hydroxy-PBDE)



2,3,4,7,8-pentabromodibenzofuran
(PBDF)

What We Know

- Ubiquitous in environment, biota
- Mammalian Toxicity
 - Endocrine disruption (PBDEs, TBBPA)
 - Dioxin formation (PBDEs, TBBPA)
 - Altered behavior and learning (PBDEs)
 - Inadequate testing for cancer, brain development, sensitization effects
- Ecological Toxicity
 - Photolytic and/or anaerobic debromination
 - Formation of dioxins, furans upon incineration

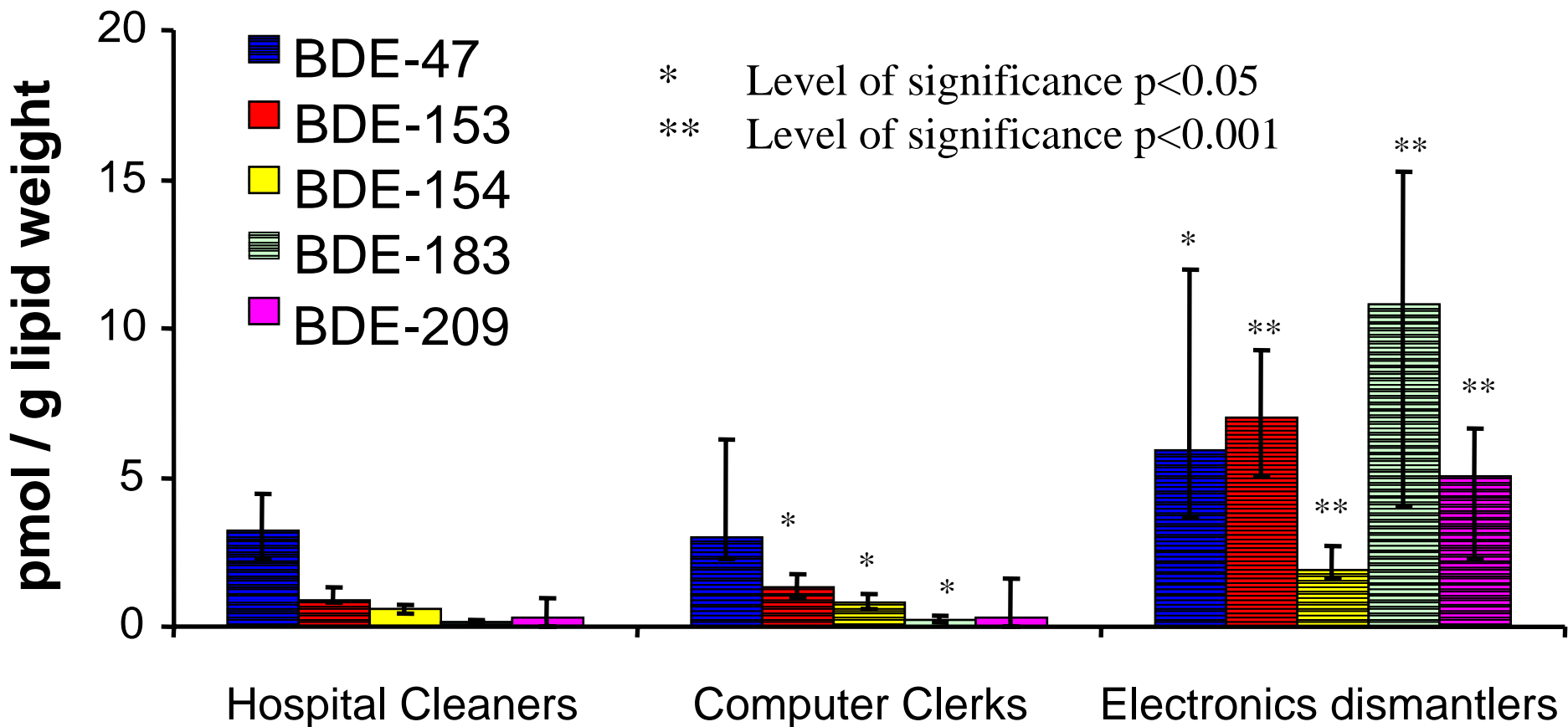


PBDEs Are Everywhere

- Indoor/ outdoor air, office dust
 - European Parliament buildings: Greenpeace
- Rivers, lakes, sediments
- Bio-solids, used for agricultural fertilizer
- Arctic, marine and terrestrial mammals
 - Long-range transport
 - Bio-concentration
- Food



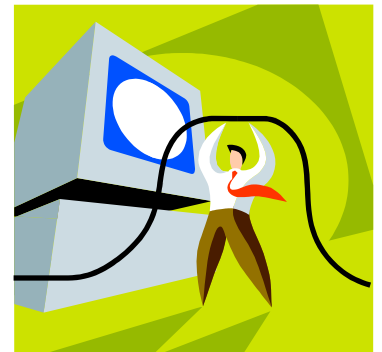
Serum PBDE Levels in Three Occupational Groups



Sjodin et.al. Environ. Health Perspect. 1999, 107, 643-47.

Emerging Issues

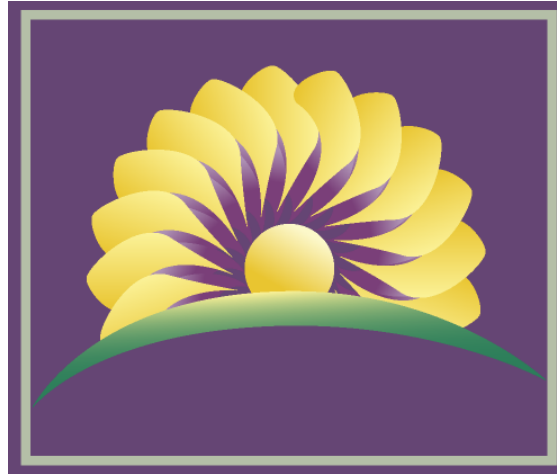
- Potential exposures
 - Export of harm when recycling done off-shore
 - Use of prisoners for US electronics recycling
 - Fire fighters' occupational exposure
 - As yet unknown impact in foam, recycled foam industries (carpets, auto, etc.)
- Impact on Recycling
 - What do we do with BFR plastic from electronic waste?



Larger Impacts

- Case study for inadequacies of current chemicals management approach
 - Grossly inadequate data before chemicals put on market
 - » 85,000 chemicals in use, with 1,000 added every year
 - No data on interactions with other chemicals
 - No systematic assessment of potential persistence, bio-accumulative properties, long-range transport, breakdown, etc.
- Need:
 - Better ongoing monitoring of humans, environment
 - Better data PRIOR to putting chemicals on the market
 - Alternatives, alternatives, alternatives





Ann Blake, Ph.D.

510-769-7008

annblake@comcast.net